Remedial Assessment Report:

Columbia Falls Aluminum Company

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Region 6

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REMEDIAL ASSESSMENT REPORT

Objectives

This report will evaluate potential sources of contamination and contaminants of potential concern (COPCs) from the aluminum smelting process. This analysis of sources and contaminants will be derived from reviewing information from five aluminum smelters. The five aluminum smelters are:

- Alcoa Vancouver Potliner NPL Site
- Kaiser Aluminum (Mead Works)
- National Southwire Aluminum Company
- Reynolds Metals Company (Troutdale, OR)
- Reynolds Metals Reduction Plant (Longview, WA)

In addition, the report will evaluate potentially contaminated media and potentially exposed receptors from the release of contaminants from the Columbia Falls Aluminum Company facility.

Overview of the Columbia Falls Aluminum Company

Columbia Falls Aluminum Company (CFAC) plant near Columbia Falls, MT began operation in 1955 and ceased operation in 2009. The CFAC plant produced aluminum by means of a cathode anode system. The cathode cell (pot) is lined with black carbon (potliner) that when in contact with aluminum oxide (alumina) reduces to aluminum using the Hall-Héroult electrolysis process.

The electrolysis process potentially can produce the following contaminants: fluoride waste including perfluorocarbons, hydrogen fluoride, sodium fluoride and aluminum fluoride, polycyclic aromatic hydrocarbons (PAHs), sulphur dioxide and cyanide. In addition, polychlorinated biphenyls (PCBs) potentially can be present from transformer spills. Hazardous wastes reported to be produced at the site include spent halogenated solvents (F001) and nonhalogenated solvents (F005).

The CFAC facility is bounded by the Teakettle Mountain, Flathead River and Cedar Creek to the east, south, and west, respectively.

Potential contaminant sources at the CFAC facility:

- Landfills
    - West Landfill
    - East Landfill (Spent Potliner Landfill)
    - Wet Scrubber Sludge Pond Landfill
    - Center Landfill
    - Sanitary Landfill
    - Asbestos Landfill
    - Industrial Landfill

- Ponds
    - North and South Leachate Ponds
    - North Percolation Pond
    - West Percolation Ponds
    - South Percolation Pond
    - Wet Scrubber Sludge Pond

- Reduction Plant
    - Storage Tanks
    - Rectifier Yard Transformer
    - West Rectifier Yard Capacitor Bank
    - Industrial Byproducts Area
    - Cathode Soaking Pits
    - Material Loading/Unloading Areas

Contaminants of Potential Concern:

- Inorganic Chemicals
    - Aluminum
    - Cyanide
    - Fluoride
    - Beryllium
    - Chromium
    - Copper
    - Nickel
    - Zinc
    - Asbestos
- Organic Chemicals
    - Nonhalogenated solvents (F005 waste)
    - Halogenated solvents (F001 waste)
    - Benzene, toluene, ethyl benzene and xylene (BTEX)
    - Polycyclic aromatic hydrocarbons (PAHs)
    - Polychlorinated biphenyls (PCBs)

Potentially contaminated media:

- Soil
- Groundwater
- Surface Water
- Sediment
- Vegetation
- Fish

Potentially exposed receptors:

- Human health receptors
  - On-site
  - Off-site
- Ecological receptors
  - Terrestrial
  - Aquatic

Alcoa Vancouver Potliner NPL Site

The Cleanup Action Plan (1992) presented the cleanup decisions for three waste piles, the soil under the piles and the groundwater. The piles contained spent potlining from the Hall-Héroult electrolysis process. Groundwater and soil sampling found the presence of cyanide and fluoride; though, the cyanide and fluoride groundwater plumes did not correlate with each other. Trichloroethylene (TCE) was detected in groundwater, but TCE appeared to be from another site.

Potliner

Potliner analysis indicated two chemicals of potential concern (COPC): cyanide and fluoride.

Soil

Soil samples were analyzed for cyanide and fluoride and contamination was found in shallow and intermediate zone soil.

Surface Water

Standing surface water in the vicinity of the waste piles were analyzed for total cyanide and cyanide was detected.

Groundwater

Cyanide, fluoride and TCE were detected in the groundwater. TCE contamination appeared to be a separate site adjacent to the site.

Kaiser Aluminum (Mead Works)

The Record of Decision (ROD) for the Kaiser Aluminum indicated that the facility used the Hall-Héroult electrolysis process to reduce aluminum oxide (alumina) to aluminum. The primary wastes associated with the process were:

- Spent potlining (SPL)
- Pot soaking liquor
- Sludge from air pollution control equipment
- Used anode waste (called butt tailings)
- Firebrick and general solid waste

Spent potlining

The primary COPCs from SPL were cyanide and fluoride.

Pot Soaking Liquor

Until 1978, the failed pots were taken off line and transported to a concrete slab. The pots were then filled with water and allowed to soak for several days. The soaking loosened the carbon and insulation material from the steel shells. The pot soaking water or liquor was removed and disposed of on the ground or sometimes into the sludge drying beds. The soaking practice was discontinued after groundwater contaminated with cyanide and fluoride was discovered beneath the facility.

Wet-Air Scrubber Sludge

The scrubber generated sludge with high fluoride levels and was disposed of ultimately into the sludge drying beds. Calcium carbonate or calcium oxide slurry was sprayed through the air scrubber to precipitate calcium fluoride and the calcium fluoride was removed in a settling pond. The calcium fluoride formed sludge.

Used Anode Waste

Used anode waste called butt tailings were generated by a process to clean anode butts after removal from the anode rods. The used anode waste was determined to not be dangerous and did not contain cyanide.

Brick and Rubble Pile Waste

The waste was found to contain some SPL.

The cyanide and fluoride groundwater contamination from the Kaiser facility migrated to domestic water supply wells. Kaiser gave residents whose wells were contaminated three options to provide them with water without cyanide and fluoride contamination. Groundwater containing cyanide and fluoride was found to be entering the surface water in the Little Spokane River.

National Southwire Aluminum Company

The Hazard Ranking System (HRS) Documentation Record and the Agency for Toxic Substances and Disease Registry (ATSDR) Preliminary Public Health Assessment for the National Southwire Aluminum (NSA) Company indicated that the facility used the Hall-Héroult electrolysis process to reduce aluminum oxide (alumina) to aluminum. The facility in Hancock County, Kentucky, had two clay-lined ponds that were constructed for the disposal of SPL (North Pond) and calcium fluoride slurry or sludge (North and South Ponds). In 1985, NSA found cyanide in one of its three supply wells.

Polychlorinated biphenyls (PCBs) were detected in on-site soil and were not detected in off-site soils. Highest levels of PCBs were found in deep foundation excavation and at the Dump Pad location. PCBs were found in fish from the Ohio River but the NSA facility is unlikely to be the source.

ATSDR health assessment was concerned about the potential for skeletal fluorosis if workers had continuous soil exposure.

Reynolds Metals Company (Region 10, Troutdale, OR)

The Reynolds facility at Troutdale, OR is a primary aluminum reduction plant where alumina is reduced to aluminum. The plant used the "prebake" method of producing aluminum where carbon electrodes are produced at the carbon plant and set into carbon-lined reduction cells (pots). The carbon potlining serves as the cathode and the carbon electrodes serves as the anode. The reduction takes place as electricity passes from the anode to the cathode and the aluminum oxide (alumina) is reduced to aluminum using the Hall-Héroult electrolysis process. The molten aluminum settles to the bottom of the pot and is regularly siphoned or tapped off. Other metals (i.e., copper, beryllium and chromium) are added to produce various aluminum alloys. Twenty-one separate waste streams are identified from the smelting process.

Former Potliner Disposal Area

Analytical results indicated significant concentrations of cyanide, fluoride and PAHs in soil samples. In addition, other metals were found in soil at levels higher than background such as arsenic, barium, beryllium, copper, nickel, iron, vanadium and zinc. Significant levels of barium, cyanide, fluoride and manganese were detected in groundwater samples.

Former Cryolite Pond

The pond was used to store and recover cryolite (sodium aluminum fluoride) from the aluminum reduction process. Analytical results found levels of aluminum, fluoride and sodium that were higher than background soil. In addition, other metals were found at soil levels higher than background such as arsenic, beryllium, copper, nickel, vanadium and zinc.

Storage and Scrap Yard

This area of the facility is used to store used or obsolete equipment and scrap metal. Analytical results indicated soil levels greater than background for inorganic chemicals such as aluminum, beryllium copper, cyanide, fluoride, iron, nickel and zinc, and organic chemicals such as the PAHs.

Refractory Brick

Refractory brick was used as a stabilization material along the Columbia and Sandy Rivers. Beryllium, nickel and fluoride concentrations were found at levels in soil greater than background under the refractory brick.

Drainage Ditch

Surface water in the drainage ditch south of the facility has significant concentrations of aluminum, barium, cyanide and fluoride.

Reynolds Metals Reduction Plant (Longview, WA)

The Reynolds Metals Reduction Plant in Longview, WA is a former aluminum smelter and cable plant. The current land use for the site is a multi-product bulk terminal.

Surface Water

Water samples were collected from on-site ditches and the Columbia River. No exceedances of screening levels were observed.

Groundwater

Groundwater samples were collected and found that cyanide, fluoride and PAH concentrations exceeded screening levels.

Soil

Rectifier Yards

Soil samples collected from the Rectifier Yards had detectable levels of PCBs, but the PCB concentrations were below the screening levels.

Floor Sweeps and Industrial Landfills

Soil samples collected from the landfills had detectable levels of cyanide, fluoride, PCBs, PAHs and volatile organic chemicals (VOCs), but the chemical concentrations were below the screening levels.

Cable Plant

Soil samples collected from the cable plant had detectable levels of cyanide, fluoride and PAHs, but the chemical concentrations were below the screening levels.

CFAC Conceptual Site Model

Potential Site Contaminant Sources

Contaminant Source	Cyanide	Fluoride	Metals	PAHs	PCBs	BTEX	Asbestos
West Landfill	x	x	x				
East Landfill (spent potliner landfill)	x	x		x			
Wet Scrubber Sludge Pond Landfill	x	x	x	x			
Center Landfill (Carbon Pile)	x	x	x	x			
Sanitary Landfill	x	x	x	x	x		
Asbestos Landfill							x
Industrial Landfill							
North & South Leachate Ponds	x	x					
North Percolation Ponds	x	x	x	x		x	
West Percolation Ponds		x	x				
South Percolation Ponds		x		x	x		
Storage Tanks						x	
West & Center Landfills	x	x	x	x	x		
Rectifier Yard Transformer					x		
West Rectifier Yard Capacitor Bank					x		
Industrial Byproducts Area	x	x	x	x			
Cathode Soaking Pits	x	x	x	x	x		
Material Loading / Unloading Areas	x	x	x	x	x		

Potentially Contaminated Media

Soil

Soil in the landfills could be contaminated with cyanide, metals and PAHs. The following metals are associated with aluminum alloy production: beryllium, chromium, copper, nickel and zinc. Soil in the rectifier yards potentially contaminated with PCBs from transformer explosions and spills. Asbestos land fill could contribute asbestos contamination to soil.

Groundwater

Groundwater down gradient of the landfills could be contaminated with cyanide, fluoride and petroleum related compounds including benzene, toluene, ethyl benzene and xylene (BTEX). Cyanide and fluoride has been detected down gradient of the North Percolation Pond (received water that was used to soak spent potliner). East Landfill (spent potliner landfill) and the adjacent North and South Leachate Ponds could contribute cyanide and fluoride to the groundwater. Groundwater down gradient of the storage tanks could be contaminated with BTEX compounds.

Surface Water

Surface water in Cedar Creek and the Flathead River could be receiving contaminated runoff from the CFAC facility. Surface water in the Flathead River could be receiving groundwater contaminated by the CFAC facility upwelling into the Flathead River.

Sediment

Sediment in Cedar Creek and the Flathead River could be receiving contaminated runoff from the CFAC facility.

Potentially Exposed Receptors

Human health and ecological receptors could be exposed to potentially contaminated soil, groundwater, surface water and sediment.

Human health receptors

- On-site Future Commercial Industrial Worker

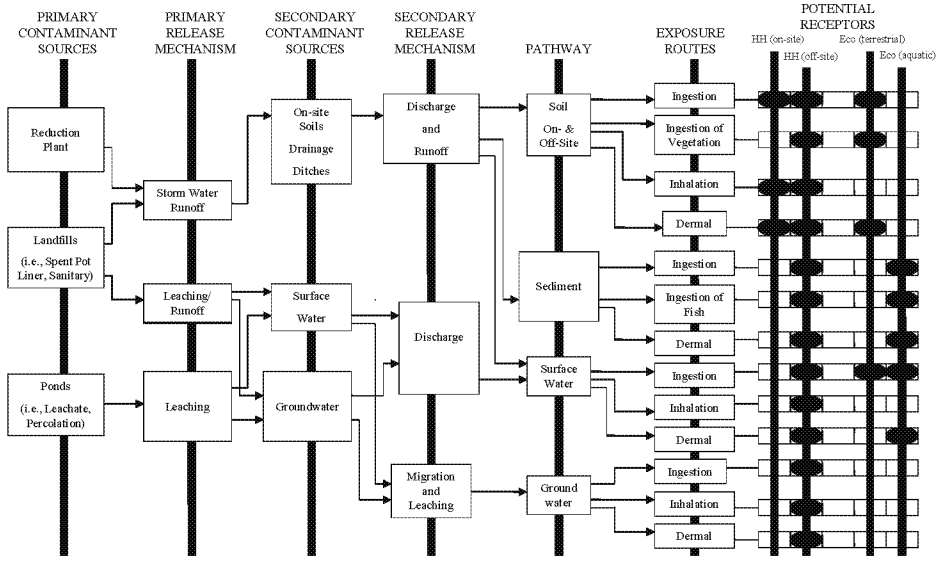
  A future commercial/industrial worker could be exposed to potentially contaminated soil and potentially contaminated drinking water while working. A trespasser exposure scenario could be added later.

- Off-site Residential

  Off-site residents could be exposed to potentially contaminated soil, sediment, surface water, groundwater and garden vegetables. A recreational exposure scenario could be added later.

Sources	Associated Contaminant	Release Mechanism	Secondary Source	Secondary Release Mechanism	Pathway - Contaminated Medium	Potential Exposure Routes
Reduction Plant	PCBs PAHs Metals	Runoff	Soil	Runoff	Soil	Ingestion Dermal Inhalation
					Sediment	Ingestion Dermal
Landfills	Cyanide Fluoride Metals PAHs PCBs Asbestos	Runoff	Soil	Runoff	Soil	Ingestion Dermal Inhalation
			Surface Water	Runoff	Surface Water	Ingestion Dermal Inhalation
		Leaching	Groundwater	Leaching and Migration	Groundwater	Ingestion Dermal Inhalation
Ponds	Cyanide Fluoride Metals PAHs BTEX	Leaching	Groundwater	Discharge	Surface Water	Ingestion Dermal Inhalation
				Leaching and Migration	Groundwater	Ingestion Dermal Inhalation

Conceptual Site Model



Ecological receptors

- Terrestrial

  Terrestrial receptors could be exposed to potentially contaminated soil, vegetation and surface water.

- Aquatic

  Aquatic receptors could be exposed to potentially contaminated surface water, sediment and prey items.